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Produce Yellow-Poplar Furniture Dimension at Minimum Cost by Using YELLOPOP

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ORIGINAL

COMPLETED

Abstract

Describes a computer program called YELLOPOP that determines the least-cost combination of lumber grades required to produce a given cutting order of yellow-poplar furniture dimension parts. If the least-cost mix is not available, YELLOPOP can be used to determine the next best alternative. The steps to use the program are described.

The Author

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Yellow-poplar continues to be an important raw material in the U.S. furniture industry. Although its use as a core material has been largely replaced by particleboard, yellow-poplar still accounts for about 20 percent of the furniture industry's total lumber requirements.

To assist the hardwood furniture and dimension industries, a computer program called YELLOPOP has been developed by the USDA Forest Service to facilitate the production of yellow-poplar furniture dimension at minimum cost. YELLOPOP determines the least-cost combination of yellow-poplar lumber grades required to produce a given cutting order of dimension parts. If that combination is not available, YELLOPOP can be used to determine the next best alternative. In addition, it can be used as a decisionmaking tool to evaluate numerous day-to-day problems in the management of a furniture rough mill.

YELLOPOP Program

The YELLOPOP analysis uses a linear programing technique to correlate the cost associated with each grade of yellow-poplar lumber with the predicted yields of each cutting size obtainable from that grade. This correlation leads to the combination with the lowest total cost.

The yield values for each grade were developed from the charts published in "Dimension Yields from Yellow-Poplar Lumber" (Gilmore et al. 1984). The actual numerical yield values for random-width pieces and the yield adjustments for cuttings of specific widths for Firsts and Seconds (FAS), First and Seconds One Face (F1F), No. 1 Common (1C), No. 2A Common (2A), and No. 2B Common (2B) are extrapolated from the yield values in Tables 1–10 (Appendix). Yields are based on 4/4 kiln-dried yellow-poplar lumber (Volumes refer to lumber measured in the dry condition). The dimension cuttings from all grades are clear, two-face, with the exception of the No. 2B grade yields, which are for sound two-face cuttings. The yield values are not necessarily the maximum attainable from any individual board. Rather, they simulate a highly skilled operator who can make consistently good decisions on where to place the saw lines. Therefore, the predicted yields should be achievable in a well-run rough mill.

Cutting orders containing pieces of any length from 10 to 96 inches and pieces with specific widths (no glueline) up to 5-1/2 inches can be evaluated by YELLOPOP. However, the maximum length piece obtainable from each grade is limited to: 96 inches for FAS; 96 inches for F1F; 60 inches for No. 1C; 40 inches for No. 2A; and 40 inches for No. 2B.

The yield values contained in Tables 1–10 are based on the longest length cutting obtained from each grade. For example, if the longest length obtained from FAS grade was 90 inches, Table 1 shows that for every thousand board feet (M bf) of rough FAS lumber input, you can expect a yield of 400 net board feet (or 40 percent) of 90-inch long cuttings that are 1 inch and wider (random width). If you want only 2-inch-wide pieces that are 90 inches long, Table 2 shows that the yield value must be reduced by 22 net board feet. Therefore, the predicted yield of 90-inch-long by 2-inch-wide cuttings is 378 net board feet for every M bf input. Yields for subsequent (shorter) cuttings from FAS are derived from the column of yields having 90 inches as its longest length. If the next length to come from FAS is 70 inches, the predicted yield is 533 net board feet per M bf input (Table 1). However, if the available 378 net board feet of 90 x 2-inch cuttings were already removed, the yield of 70-inch random-width cuttings is actually 155 net board feet (533-378) for each M bf input. The predicted yield of each shorter subsequent cutting would be calculated in a similar fashion. Although the process is very time-consuming to do longhand, the computer can evaluate all possible combinations of cutting sizes and lumber grades easily.

Data Entry

The data entry screen for the YELLOPOP program is shown in Figure 1. For later reference, you enter the date, name or model number of the cutting order, and the thickness of the lumber required. The input factors used by the program include the cost per M bf associated with each grade of yellow-poplar that you wish to have considered in the possible least-cost mix, adjustments you want to make to the predicted yields for each grade, and volume constraints you want placed on the grades.

The cost of each grade, expressed in dollars per M bf, should represent the sum of all costs associated with that grade through the rough mill. Cost items to be included are at the discretion of the user but could include the cost for lumber purchase, delivery, drying and handling, rough mill cut-up, inventory, and overhead.

The yield adjustment factor can be used to modify the predicted yields of any grade. Acting as a percentage adjustment to the predicted yields, the yield adjustment factor can be used to adapt the basic yields for admissible defects, thicknesses of lumber over 4/4, or general rough-mill efficiency.

The volume constraints are used to limit the amount of a grade being considered. The resulting YELLOPOP analysis may or may not use all of the grade in limited supply, but the least-cost grade mix will never contain more of that grade than the volume allowed. This feature of the program is generally used in determining the next best alternatives.

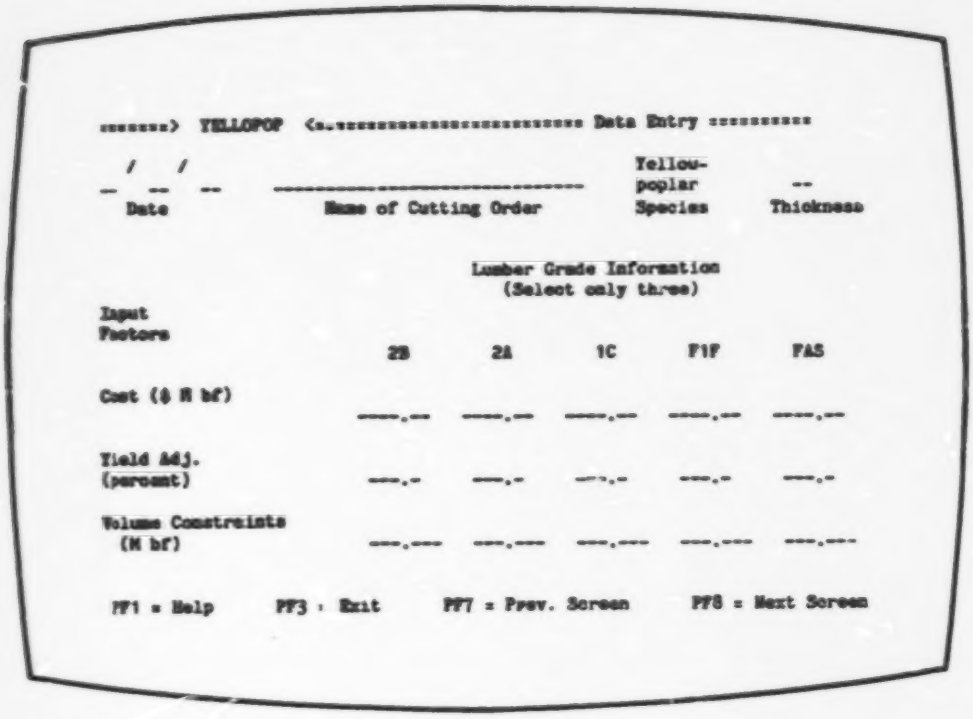


Figure 1.—Blank Data Entry screen.

Cutting Order

Now that the grades and their associated costs have been established, the individual sizes of the pieces to be obtained are entered on the Cutting Order screen shown in Figure 2. Each size of cutting is entered by length, width, type, and number of pieces required. Up to 50 different sizes of cuttings can be entered. The type of cutting refers to whether it is of a specified width (no glueline) (S) or glued up from random widths (R).

YELLOPOP Printout

The YELLOPOP printout consists of four sections: (1) the input information evaluated, (2) the least-cost grade mix, (3) the range and sensitivity analysis, and (4) the cutting instructions for obtaining the desired cuttings. The first three sections are meant to be retained by management and filed for future reference. The last section would go to the rough-mill foreman for use in establishing the cutting instructions.

Input Information

The first section (Fig. 3) provides a record of the lumber costs used, any adjustments made, and the cutting order evaluated. Since individual cutting orders recur, it can be saved and used in making future management decisions.

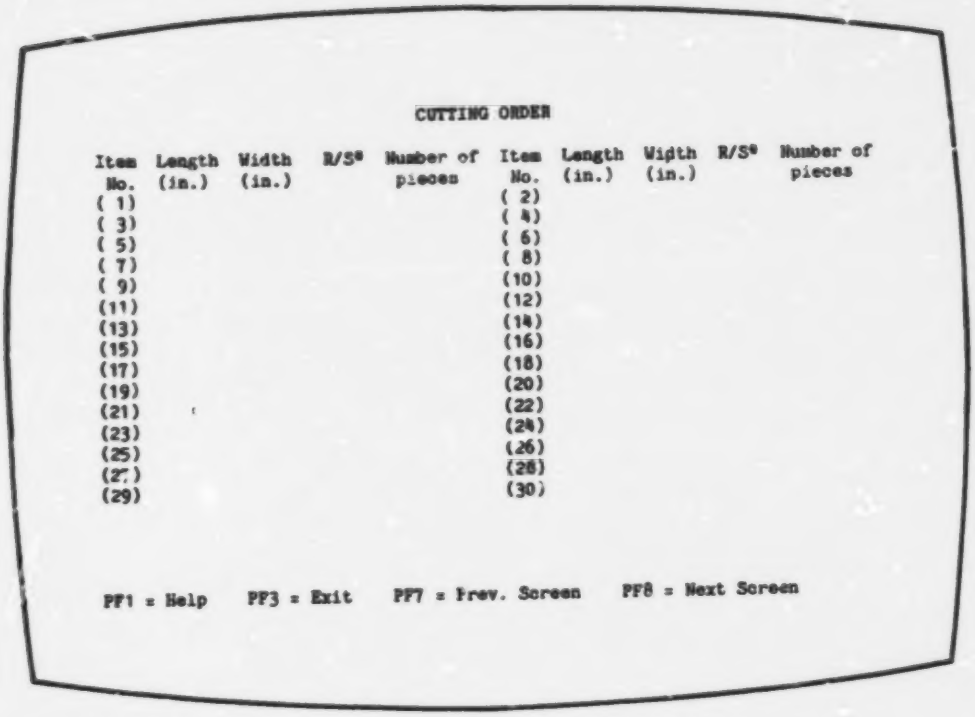
Least-Cost Grade Mix

The second section provides the least-cost grade mix solution (Fig. 4). For each grade of lumber, the printout shows the predicted lumber volume required, the grade's contribution to the total production cost, the net board feet of cuttings to be obtained from it, the percent yield, and the totals of these items for the entire cutting order.

This solution represents the best that we can do under the costs and conditions we have specified. There is no other combination of grades and volumes that will result in a lower total cost.

Range and Sensitivity Analysis

The range and sensitivity analysis (Fig. 4) is the key to using YELLOPOP as a decisionmaking tool. It indicates how good our current least-cost grade mix is relative to the next best alternatives. As such, it also indicates how we might allocate our lumber when less than optimal conditions exist.


CUTTING ORDER
Item No. Length (in.) Width (in.) R/S* Number of pieces Item No. Length (in.) Width (in.) R/S* Number of pieces
(1) (2)
(3) (4)
(5) (6)
(7) (8)
(9) (10)
(11) (12)
(13) (14)
(15) (16)
(17) (18)
(19) (20)
(21) (22)
(23) (24)
(25) (26)
(27) (28)
(29) (30)
PF1 = Help PF3 = Exit PF7 = Prev. Screen PF8 = Next Screen

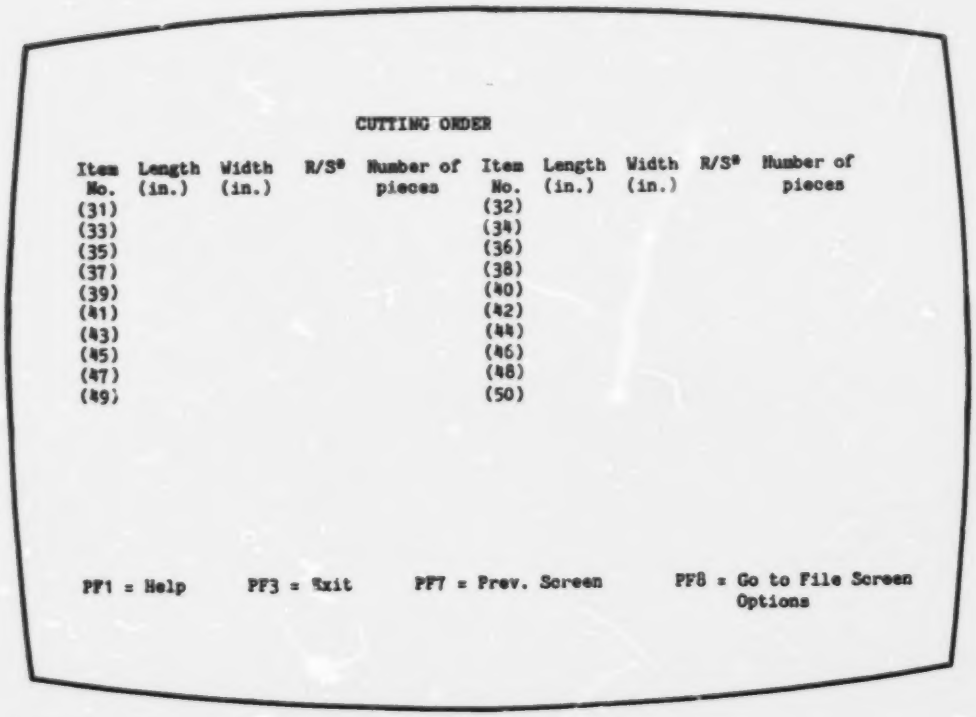

CUTTING ORDER
Item No. Length (in.) Width (in.) R/S* Number of pieces Item No. Length (in.) Width (in.) R/S* Number of pieces
(31) (32)
(33) (34)
(35) (36)
(37) (38)
(39) (40)
(41) (42)
(43) (44)
(45) (46)
(47) (48)
(49) (50)
PF1 = Help PF3 = Exit PF7 = Prev. Screen PF8 = Go to File Screen Options

Figure 2.—Cutting Order, screen 1 and screen 2.

INPUT INFORMATION SECTION OF YELLOPOP PRINTOUT

March 20, 1986--dresser--Yellow-poplar

Lumber grade	Production costs (dollars/M bf)	Grade yield adjustment factor	Volume constraints (M bf)	Lumber thickness (inches)
Number 2A Common	362.00	95.0	None	4/4
Number 1 Common	430.00	95.0	None	4/4
Firsts and Seconds	570.00	95.0	None	4/4

--Input Cutting Order--

Cutting size Length (inches)	Width (inches)	Type of cutting random (R) or specified (S)	Number of cuttings	Net board feet of cuttings
27.750	20.000	R	25	96.4
15.500	22.000	R	270	568.3
60.750	2.250	S	1000	949.2
58.125	2.250	S	3500	3178.7
31.375	3.250	S	1000	708.1
31.375	2.250	S	1000	490.2
30.000	1.750	S	1000	364.6
28.312	0.750	S	500	73.7
20.250	2.250	S	500	158.2
19.250	0.750	S	500	50.1
18.250	1.250	S	2500	396.1
18.000	2.625	S	1000	328.1
18.000	1.250	S	1000	156.2
17.000	2.250	S	3500	929.7
16.500	3.000	S	1500	515.6
16.500	2.000	S	2000	458.3
14.250	2.250	S	500	111.3
Totals			21265	9533.0

Figure 3.—Input information section.

LEAST-COST GRADE MIX SOLUTION

March 20, 1986--Aztec Dresser--Yellow-poplar

-- Summary by Grade --

Selected grades	Input cost/M bf (dollars)	Gross volume (M bf)	Total production cost (dollars)	Board feet of cuttings	Percent yield
Number 2A Common	362	1.978	716	1092.7	55.2
Number 1 Common	430	14.777	6353	8014.7	54.2
Firsts and Seconds	570	0.642	365	425.6	66.3
Totals		17.396	7435	9533.0	54.8

-- Range and Sensitivity Analysis Information --

Selected grades	Input cost and levels/M bf (dollars)		Associated gross volumes (M bf)
Number 2 Common	Upper	363.60	1.921
		362.00	1.978
	Lower	328.19	1.992
Number 1 Common	Upper	440.28	14.731
		430.00	14.777
	Lower	429.56	14.985
Firsts and Seconds	Upper	570.76	0.521
		570.00	0.642
	Lower	552.25	0.668

Figure 4.—Least-cost grade mix solution.

The range and sensitivity analysis shows the range over which the input cost of each grade can move without a change in the least-cost grade mix, assuming the input cost of the other grades remains unchanged. By varying the input cost of one grade while holding the others constant, the program determines at what level of input cost there would be a change in how the grades are used to obtain the cuttings required. The "associated gross volumes" then show the volume of the grade that would be used at that input cost.

Figure 4 shows that if the input cost of FAS increased by 76 cents per M bf, the volume of FAS used in the alternative least-cost mix would drop by 121 board feet to 521 board feet. Although hardly earth-shaking, an astute manager may see this as an indication that FAS could be eliminated entirely. If, in fact, YELLOPOP is rerun without any FAS, it would be found that a mix of 15.884 M bf of No. 1C and 1.673 M bf of No. 2A would result in a total cost of $7,436 or only $1.00 more than our least-cost mix. As a matter of fact, both FAS and No. 2A could be eliminated for an additional $46 over the least-cost mix. The capability to evaluate the cost of different options can be a help to managers.

For a more complete discussion of the interpretation of the range and sensitivity analysis and how it can be used as a decisionmaking tool, obtain a copy of "OPTIGRAM: Optimum Lumber Grade Mix for Hardwood Dimension Parts" (Martens and Nevel 1985).

Cutting Instruction

The last section of the YELLOPOP printout is the cutting instruction (Fig. 5) for obtaining the required dimension cuttings from the proposed least-cost mix. The rough-mill foreman uses this section to assign cutting lengths to specific crosscut saw operators.

It provides the input volume of each grade according to the least-cost mix, the cutting sizes that are to be obtained from each grade, and the number of pieces that are expected from that volume of lumber.

The program evaluates all combinations of cutting requirements and yield per grade to determine the least-cost combination. The results are not always according to tradition. For example, in the cutting instructions shown (Fig. 5), the longest length in the cutting order (60.750 inches) is obtained exclusively from No. 1C and not FAS. Instead, FAS is used to supplement the requirements for 58.125-, 17.000-, and 15.500-inch cutting lengths and provide all of the 28.312- and 19.250-inch cutting lengths. The fact that FAS was used to supplement relatively short lengths helps explain how it could be completely eliminated from the mix at a total added cost of $1.00.

This last section also provides a value called "board feet shorts." This represents the net board feet of unused volume that would be available as 10-inch-long, random-width cuttings. As such, it provides an indication of how well the raw material is being utilized.

In addition to the information on each grade, the entire cutting order is summarized. Included in the summary are the total gross volume of lumber required, the total net board feet of cuttings to be obtained, the total board feet of shorts anticipated, and the total number of pieces required.

Using YELLOPOP

YELLOPOP is designed for use on any IBM mainframe computer with a mathematical programing system (MPS) in its program library. The program can be accessed through an on-site computer or through a remote terminal.

Remote Terminal

For those using a remote terminal, YELLOPOP has been placed on the Computerized Management Network (CMN), a national time-sharing computer service managed by the Virginia Cooperative Extension Service. Access to CMN can be made on any ASCII terminal and a modem or on a microcomputer with a communications program.

The CMN is accessed through normal long distance telephone lines. To LOG ON, you will need to obtain a CMN user identification number (userid) and password by contacting:

Virginia Polytechnic Institute and State University
Virginia Cooperative Extension Service
Extension Computing Resources
Plaza I, Building D
Blacksburg, Virginia 24061
703–961–5184

There is no initial fee or hookup charge for CMN, but there is a small monthly userid ownership charge.

To use the program, you simply dial the computer telephone number and LOG ON with your CMN userid and password. The computer will then ask you what program you would like and you enter "YELLOPOP." The Main Menu screen, shown in Figure 6, will appear and asks what you would like to do. By pressing one of the four function (PF) keys, you can request a file for editing or analysis (PF4), determine if a submitted analysis has been returned to your userid (PF5), get the HELP file (PF1), or exit from the program (PF3). For example, if you wish to make a YELLOPOP analysis, you press the PF4 key. A screen appears that asks you to enter a file name (Fig. 7). It also lists all the file names that you have previously run. To enter a file name, you may either (a) enter a name of from one to eight characters in the file name field and then

OPTIMUM SOLUTION CUTTING INFORMATION

March 30, 1986--Aztec Dresser--Yellow-poplar

Selected grades	Lumber thickness (inches)	Gross volume (M bf)	Cutting size Length (inches)	Cutting size Width (inches)	Type of cutting	Number of cuttings	Net board feet
Number 2A Common	4/4	1.978					
			27.750	20.000	R	25	96.4
			15.500	22.000	R	200	473.9
			18.000	2.625	S	981	321.8
			18.000	1.250	S	994	155.4
			14.250	2.250	S	203	45.3
Net Board Feet/Grade = 1092.7							
Board Feet Shorts = 174.1							
Number 1 Common		14.777					
			15.500	22.000	R	37	88.7
			60.750	2.250	S	1000	949.2
			58.125	2.250	S	3183	2890.9
			31.375	3.250	S	1000	708.1
			31.375	2.250	S	1000	490.2
			30.000	1.750	S	1000	364.6
			20.250	2.250	S	500	158.2
			18.250	1.250	S	2500	396.1
			18.000	2.625	S	19	6.3
			18.000	1.250	S	6	0.9
			17.000	2.250	S	3469	921.5
			16.500	3.000	S	1500	515.6
			16.500	2.000	S	2000	458.3
			14.250	2.250	S	297	66.1
Net Board Feet/Grade = 8014.7							
Board Feet Shorts = 369.9							
Firsts and Seconds		0.642					
			15.500	22.000	R	2	5.8
			58.125	2.250	S	317	287.8
			28.312	0.750	S	500	73.7
			19.250	0.750	S	500	50.1
			17.000	2.250	S	31	8.2
Net Board Feet/Grade = 425.6							
Board Feet Shorts = 21.8							

Total Gross Volume (M bf)	Total Net Board Feet	Total Shorts (bf)	Total Number of Pieces
17.396	9533.0	565.8	21264

Figure 5.—Optimum solution cutting information.

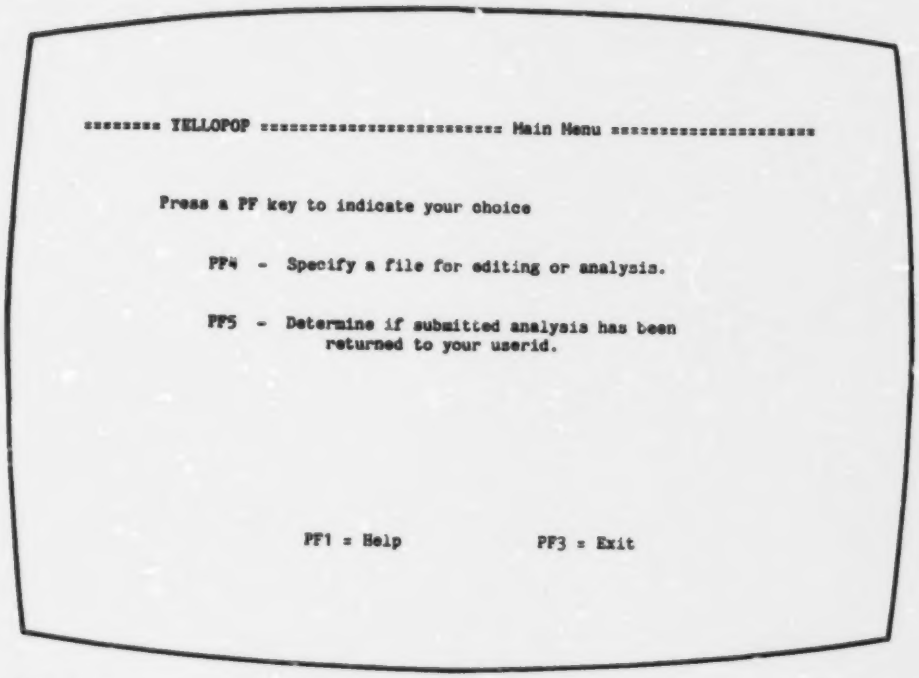

======== YELLOPOP ========== Main Menu ==========
Press a PF key to indicate your choice
PF4 - Specify a file for editing or analysis.
PF5 - Determine if submitted analysis has been returned to your userid.
PF1 = Help
PF3 = Exit

Figure 6.—Main Menu.

press the ENTER key, or (b) position the cursor at the name of one of your existing files and then press ENTER (this copies the name at the cursor to the file name field at the top of the screen); then press ENTER again to validate the name you have selected. A message will appear at the bottom of the screen indicating that the requested file is an old file.

Now that you have selected your file, press the PF8 key, as shown at the bottom of the screen, to proceed to the File Options screen (Fig. 8). As shown, you press a PF key to select whether you want to edit the selected file (PF4), submit the file for processing (PF5), or specify your job priority (PF6).

Since we are interested in making an analysis, we would press PF4 to proceed to the Data Entry screen shown earlier in Figure 1. Fields for all necessary data input are labeled. These include date, cutting order name, thickness, lumber grades to be selected and their respective costs, yield adjustments, and volume constraints. On the Data Entry screens, you can move the cursor with the cursor controls or skip from field to field with the TAB key.

In the example Data Entry screen (Fig. 9), we have specified 4/4 thickness and the lumber grades of 2A, 1C, and FAS. The input costs of $362, $430, and $570, respectively, reflect estimates of the total of costs for each grade through the rough mill. The 95 percent yield adjustment is for demonstration purposes only. Since no volume constraints were used, the program assumes that there are unlimited volumes available for each grade. We would now press PF8 to move to the next screen, which is where we enter our cutting order (Fig. 10). YELLOPOP can accommodate 50 specific cutting sizes (30 on this screen and 20 on the next screen). Each is entered by length, width, type, and number of pieces. An R is used for panels that will be glued up from random-width pieces, and S is used when each part is to have a specified width (no glueline). Part sizes do not need to be entered in a particular order, such as from longest to shortest lengths.

Pressing the PF8 key takes us to screen 2 of the cutting order and pressing PF8 again takes us back to the File Options screen (Fig. 8). If we press PF6 on the File Options screen, we can specify our job priority (Fig. 11). Five levels of priority can be selected from idle (least expensive) to urgent (most expensive). If no selection is made, the program is preset to run on idle priority. Assuming that we are satisfied with our priority, we press PF5 to submit our file for processing. We will receive a message at the bottom indicating that "YELLOPOP job submitted. Check for results after 10 minutes."

BEST COPY AVAILABLE

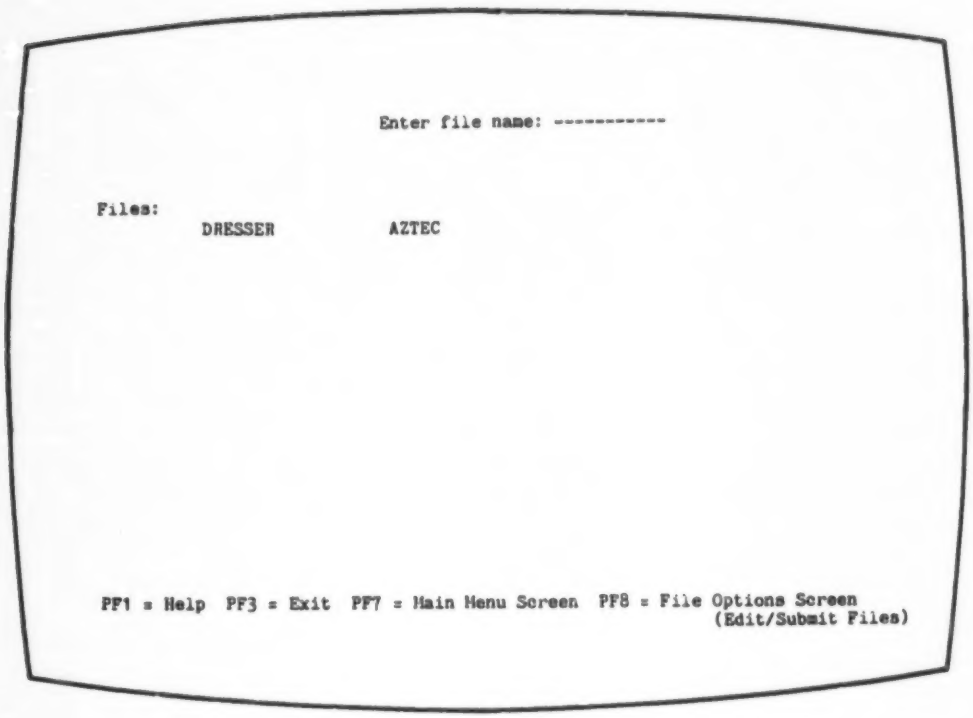


Figure 7.—File Name screen.

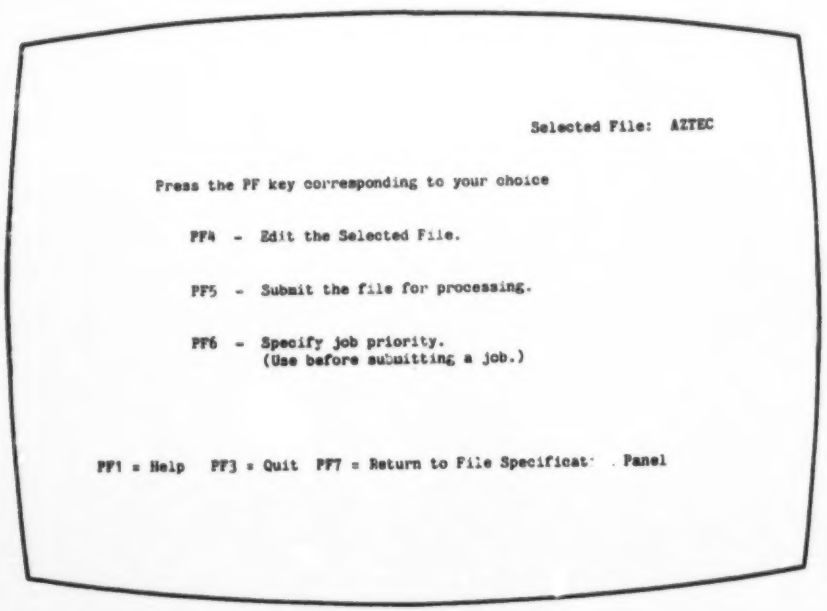

Selected File: AZTEC
Press the PF key corresponding to your choice
PF4 - Edit the Selected File.
PF5 - Submit the file for processing.
PF6 - Specify job priority.
(Use before submitting a job.)
PF1 = Help PF3 = Quit PF7 = Return to File Specificat Panel

Figure 8.—File Options screen.

BEST COPY AVAILABLE

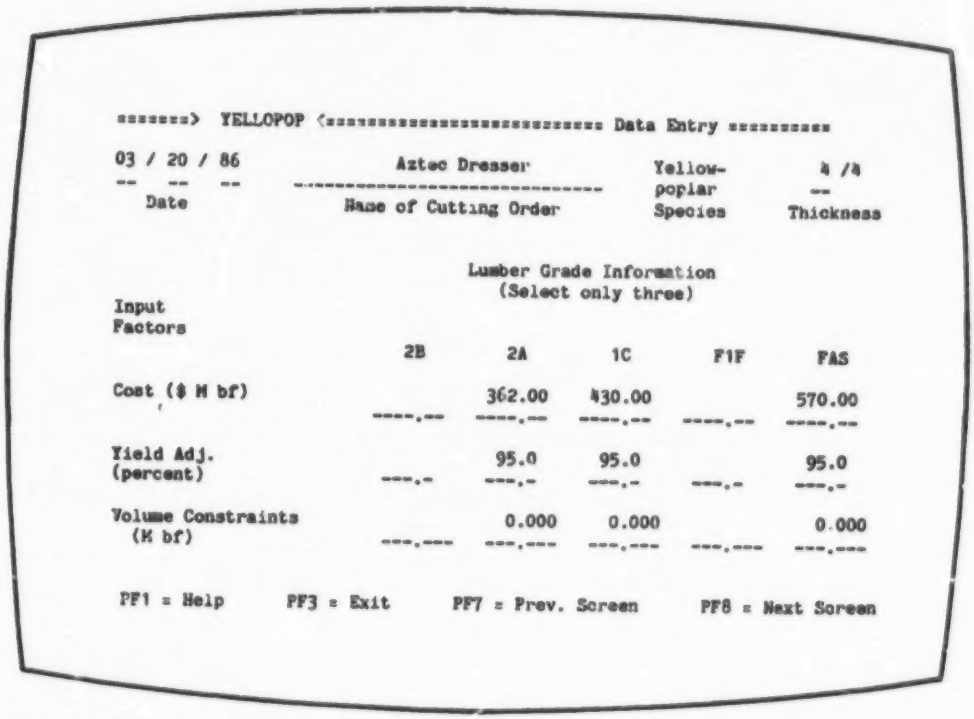


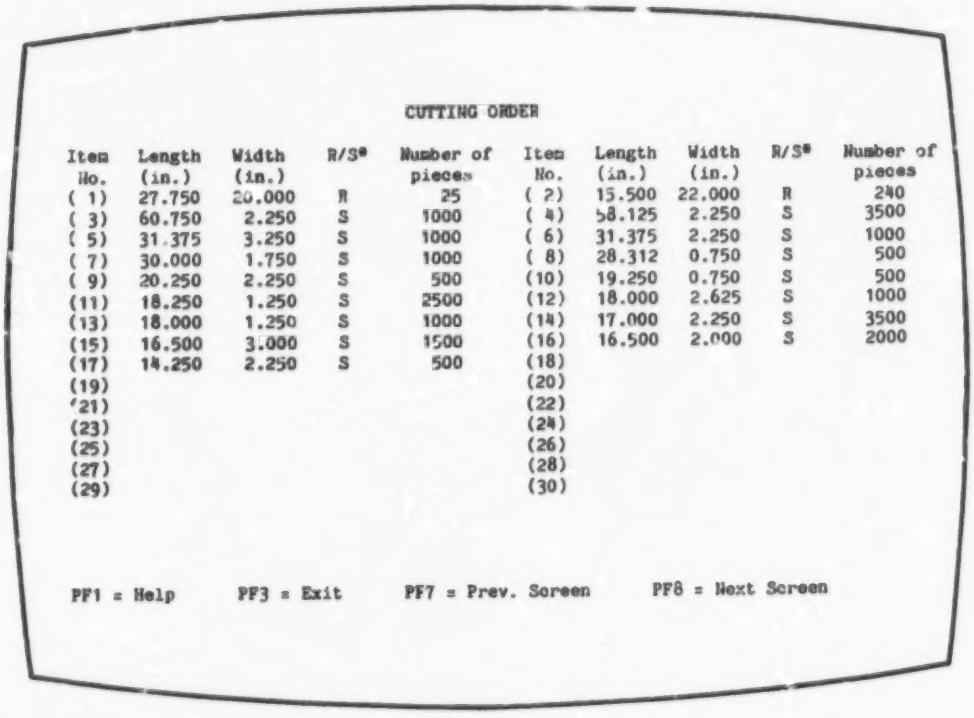
Figure 9.—Completed Data Entry screen.

We can now press PF4 to make changes in our file if we want to rerun it with different lumber input costs, yield adjustments, or volume constraints. If we want to enter another analysis, we can press PF7 to go back to the File Specification screen (Fig. 7).

To receive our YELLOPOP output, we return to the Main Menu screen (Fig. 5) and press the PF5 key to determine if our submitted analysis has been returned to our userid. If it has not come back, we will receive a message at the bottom of the screen saying, "No YELLOPOP output has been returned. Try again later." When the analysis is completed, the output is returned to our "reader." To look at the output, we press PF11 as indicated on the screen. This makes the entire YELLOPOP output available to you. You can look through it by using the PF8 and PF7 keys to scroll forward and backward, respectively.

If you wish to keep the output, you press the PF9 key to have it recorded onto your CMN disk space as a permanent record or to have it printed. If you have a printer attached to your terminal, you can have your results printed by using the command "TPRINT" followed by the file name that you used in your File Name screen shown in Figure 7. You can also discard the output by pressing the PF2 key or have it printed at Virginia Polytechnic Institute and State University (VPI&SU) by pressing the PF4 key. VPI&SU will then send you the results. By pressing the PF3 key, you will be returned to the Main Menu.

On every screen requiring the selection of an option or the input of data, the PF1 key has been labeled HELP. After pressing it, a help file will be displayed on the screen to explain each of the options available to you.



CUTTING ORDER

Item No.	Length (in.)	Width (in.)	R/S*	Number of pieces	Item No.	Length (in.)	Width (in.)	R/S*	Number of pieces
(1)	27.750	20.000	R	25	(2)	15.500	22.000	R	240
(3)	60.750	2.250	S	1000	(4)	58.125	2.250	S	3500
(5)	31.375	3.250	S	1000	(6)	31.375	2.250	S	1000
(7)	30.000	1.750	S	1000	(8)	28.312	0.750	S	500
(9)	20.250	2.250	S	500	(10)	19.250	0.750	S	500
(11)	18.250	1.250	S	2500	(12)	18.000	2.625	S	1000
(13)	18.000	1.250	S	1000	(14)	17.000	2.250	S	3500
(15)	16.500	3.000	S	1500	(16)	16.500	2.000	S	2000
(17)	14.250	2.250	S	500	(18)				
(19)					(20)				
(21)					(22)				
(23)					(24)				
(25)					(26)				
(27)					(28)				
(29)					(30)				

PF1 = Help PF3 = Exit PF7 = Prev. Screen PF8 = Next Screen

Figure 10.—Cutting order.

Mainframe

If potential users have access to an IBM mainframe computer, they may wish to obtain a copy of our YELLOPOP program library. If you send a blank tape to the Forestry Sciences Laboratory, P. O. Box 152, Princeton, West Virginia 24740, we will have our YELLOPOP program library copied onto it and return it to sender with documentation of its contents. There will be no charge to the user.

If the IBM mainframe in question does not have an MPS package in its program library, it will be necessary to obtain it before YELLOPOP will function. An MPSX can be obtained from an IBM representative or an MPSIII can be obtained from Ketron, Inc., Management Science System Divisions, 1400 Wilson Boulevard, Arlington, Virginia 22209.

All features and capabilities available on the CMN version are also available on the mainframe version and they are operated identically.

Summary

YELLOPOP can make a significant difference in the total cost of yellow-poplar dimension parts by selecting the most economical combination of grades and volumes required to produce a given cutting order. YELLOPOP and its companion programs, OPTIGRAM and WALNUT (Martens 1986), are decisionmaking tools designed to help furniture rough-mill managers. OPTIGRAM is used to evaluate cutting orders from all species graded by the standard National Hardwood Lumber Association's rules and WALNUT is used for walnut. They are easy to use and are adaptable to individual plant situations.

=====> YELLOPOP JOB PRIORITY <=====
Mark an "X" next to the priority you want assigned to your job.
- IDLE (Least expensive)
- OVERNIGHT
- STANDARD
- PRIORITY
- URGENT (Most expensive)
PF7 = Return to Menu

Figure 11.—YELLOPOP job priority.

Literature Cited

Gilmore, Robert C.; Hanover, Stephen J.; Danielson, Jeanne D. **Dimension yields from yellow-poplar lumber.** Gen. Tech. Rep. FPL-41. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1984. 13 p.

Martens, David G. **Reduce dimension costs by using WALNUT.** Res. Pap. NE-586. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 10 p.

Martens, David G.; Nevel Robert L., Jr. **OPTIGRAMI: optimum lumber grade mix program for hardwood dimension parts.** Res. Pap. NE-563. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1985. 10 p.

Appendix

Table 1.—Predicted yields of random-width, clear 2-face cuttings from FAS grade yellow-poplar lumber (net board feet per M bf)

Length of subsequent cuttings (inches)	Length of longest cuttings									
	10	20	30	40	50	60	70	80	90	96
	Inches									
96										359
90									400	405
80								444	482	485
70							460	508	533	538
60						475	526	563	581	582
50					520	540	581	607	617	620
40				580	591	613	621	640	649	651
30			630	642	650	658	668	675	678	679
20		680	690	695	698	703	710	712	714	713
10	775	750	745	745	748	750	753	753	754	753

Table 2.—Reduction values for obtaining predicted yields for cuttings of specified widths from FAS grade yellow-poplar lumber (net board feet per M bf)

Width of cuttings (inches)	Length of cuttings									
	10	20	30	40	50	60	70	80	90	96
	Inches									
2	59	52	47	42	38	35	32	27	22	20
3	110	101	93	86	79	74	68	60	51	47
4	168	155	144	135	127	120	112	97	91	83
5	228	215	202	191	182	175	167	155	144	130
5-1/2	259	248	235	223	213	206	198	185	174	158

Table 3.—Predicted yields of random-width, clear 2-face cuttings from F1F grade yellow-poplar lumber (net board feet per M bf)

Length of subsequent cuttings (inches)	Length of longest cuttings									
	10	20	30	40	50	60	70	80	90	96
	Inches									
96										240
90									240	270
80								260	305	325
70							280	335	465	385
60						325	365	400	425	440
50					370	415	440	460	480	495
40				425	460	485	500	515	530	545
30			490	515	530	545	550	560	580	595
20		575	590	580	585	600	595	600	620	635
10	730	670	660	635	630	640	625	635	655	670

Table 4.—Reduction values for obtaining predicted yields for cuttings of specified widths from F1F grade yellow-poplar lumber (net board feet per M bf)

Width of cuttings (inches)	Length of cuttings									
	10	20	30	40	50	60	70	80	90	96
	Inches									
2	58	49	41	35	30	25	22	19	15	12
3	120	108	93	80	70	63	57	48	38	34
4	191	175	156	140	128	115	101	85	69	65
5	272	253	231	213	197	178	158	135	109	102
5-1/2	316	298	275	255	236	214	190	162	131	122

Table 5.—Predicted yields of random-width, clear 2-face cuttings from grade 1C yellow-poplar lumber (net board feet per M bf)

Length of subsequent cuttings (inches)	Length of longest cuttings							
	10	20	30	40	50	60	70	80
	Inches							
80								225
70							235	300
60						265	320	365
50					315	355	395	430
40				350	390	430	460	485
30			435	445	465	495	515	535
20		545	530	520	535	555	570	580
10	690	640	610	575	580	605	615	630

Table 6.—Reduction values for obtaining predicted yields for cuttings of specified widths from grade 1C yellow-poplar lumber (net board feet per M bf)

Width of cuttings (inches)	Length of cuttings							
	10	20	30	40	50	60	70	80
	Inches							
2	48	40	33	29	25	20	16	11
3	120	105	90	80	70	60	48	38
4	220	198	173	154	135	118	96	78
5	351	320	284	250	221	193	158	133
5-1/2	429	390	349	310	274	238	199	168

Table 7.—Predicted yields of random-width, clear 2-face cuttings from grade 2A yellow-poplar lumber (net board feet per M bf)

Length of subsequent cuttings (inches)	Length of longest cuttings			
	10	20	30	40
	Inches			
40				250
30			290	360
20		425	400	460
10	630	530	480	525

Table 8.—Reduction values for obtaining predicted yields for cuttings of specified widths from grade 2A yellow-poplar lumber (net board feet M bf)

Width of cuttings (inches)	Length of cuttings			
	10	20	30	40
	Inches			
2	55	43	32	28
3	129	105	82	68
4	219	182	147	118
5	328	278	222	175
5-1/2	388	330	267	209

Table 9.—Predicted yields of random-width, sound 2-face cuttings from grade 2B yellow-poplar lumber (net board feet per M bf)

Length of subsequent cuttings (inches)	Length of longest cuttings			
	10	20	30	40
	Inches			
40				200
30			265	285
20		380	375	375
10	605	500	470	450

Table 10.—Reduction values for obtaining predicted yields for cuttings of specified widths from grade 2B yellow-poplar lumber (net board feet per M bf)

Width of cuttings (inches)	Length of cuttings			
	10	20	30	40
	Inches			
2	60	44	32	29
3	132	100	78	62
4	220	175	131	105
5	324	260	198	150
5-1/2	380	307	235	172

Martens, David G. **Produce yellow-poplar furniture dimension at minimum cost by using YELLOPOP.** NE-RP-592. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station; 1986. 15p.

Describes a computer program called YELLOPOP that determines the least-cost combination of lumber grades required to produce a given cutting order of furniture dimension parts. If the least-cost mix is not available, YELLOPOP can be used to determine the next best alternative. The steps involved in using the program are also described.

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Keywords: Furniture, hardwood dimension; lumber yields; dimension yields

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